Visualizing Ethical Controversies and Positions by Logical Argument Mapping (LAM) – A Manual

Michael Hoffmann, m.hoffmann@gatech.edu, May 2009

Please find the most recent version of this manual (including a list of publications) at http://www.prism.gatech.edu/~mh327/LAM

Introduction

Ethical decisions are often not clear-cut. Most of the time it is possible to argue for more than one "right thing to do," especially if there is a variety of ethical principles or conflicting arguments. In order both to understand those arguments and to participate in deliberation and communication on ethically relevant issues, we need some methods, tools, and the practical skills to use them. Such a method is Logical Argument Mapping (LAM). Its main functions are to facilitate the structuring of complex knowledge areas and belief systems, and to stimulate reflection and creativity.

Logical Argument Mapping is a method to represent the inferential structure among claims by means of a system of representation (defined by rules, procedures, and conventions) that is based on **three ideas**:

1. that visualizing what we think about an issue helps us to reflect on our own thinking—and on that of others when we are using LAM to analyze given arguments
2. that the best way to represent entire "webs" of mutually supporting beliefs is to present them as networks of mutually supporting arguments, that is as an argument map with an inferential structure, and
3. that imposing the standard of logical validity on the construction of argument maps helps us to
   - evaluate the completeness and soundness of arguments
   - visualize implicit assumptions
   - criticize and improve our own thinking

1. Three basic rules

1. Represent your main argument—and every sub-argument that might be controversial—according to an argument scheme whose deductive validity is evident or can be made plausible (e.g., modus ponens, modus tollens, alternative syllogism, disjunctive syllogism, conditional syllogism, etc., but also argument schemes that are transformed from invalid forms into valid ones like complete induction, argument from perfect authority, and argument from perfect analogy; see section 4 for a list)
2. Consider the acceptability of all your premises, and provide further arguments for those whose acceptability is either not evident or controversial
3. Make sure that all your premises are consistent with each other.

2. Definitions

An *argument* is defined as a set of statements—a claim and one or more reasons—where the reasons jointly provide support (not necessarily conclusive) for the claim, or are at least *intended* to support the claim. An "argumentation" is defined here as a set of arguments in which a main argument is supported or criticized by further arguments. Since it may be necessary to provide arguments for each of the reasons of the main argument, and further arguments for the reasons of supporting arguments, and so on, the best way to represent an argumentation is an argument map.

A *logical argument* is a logically valid (or "deductively valid") argument. An argument is "logically valid" if and only if it follows an argument scheme that is logically valid. An argument scheme is logically valid if and only if it is impossible for any argument following this scheme to have true premises and a false conclusion. Lists of logically valid argument schemes used in LAM are compiled in section 4. (Note that "validity" is not "truth"; for validity the truth of the premises is simply presupposed.)

In its current version, all LAM maps are created with Cmap, http://cmap.ihmc.us/.

3. The procedure of Logical Argument Mapping

Depending on the respective purpose of Logical Argument Mapping, there are various ways to proceed. We can distinguish, however, seven elements which can be combined in concrete procedures. The first two are necessary elements, the remaining five are optional.

Necessary elements: Argument construction and evaluation

Every LAM procedure must include the construction (or re-construction) of an argument and its evaluation. The construction is constrained by a set of rules (sect. 1) which are supposed to challenge the user to construct arguments in a way that facilitates the argument evaluation in a phase of reflection.

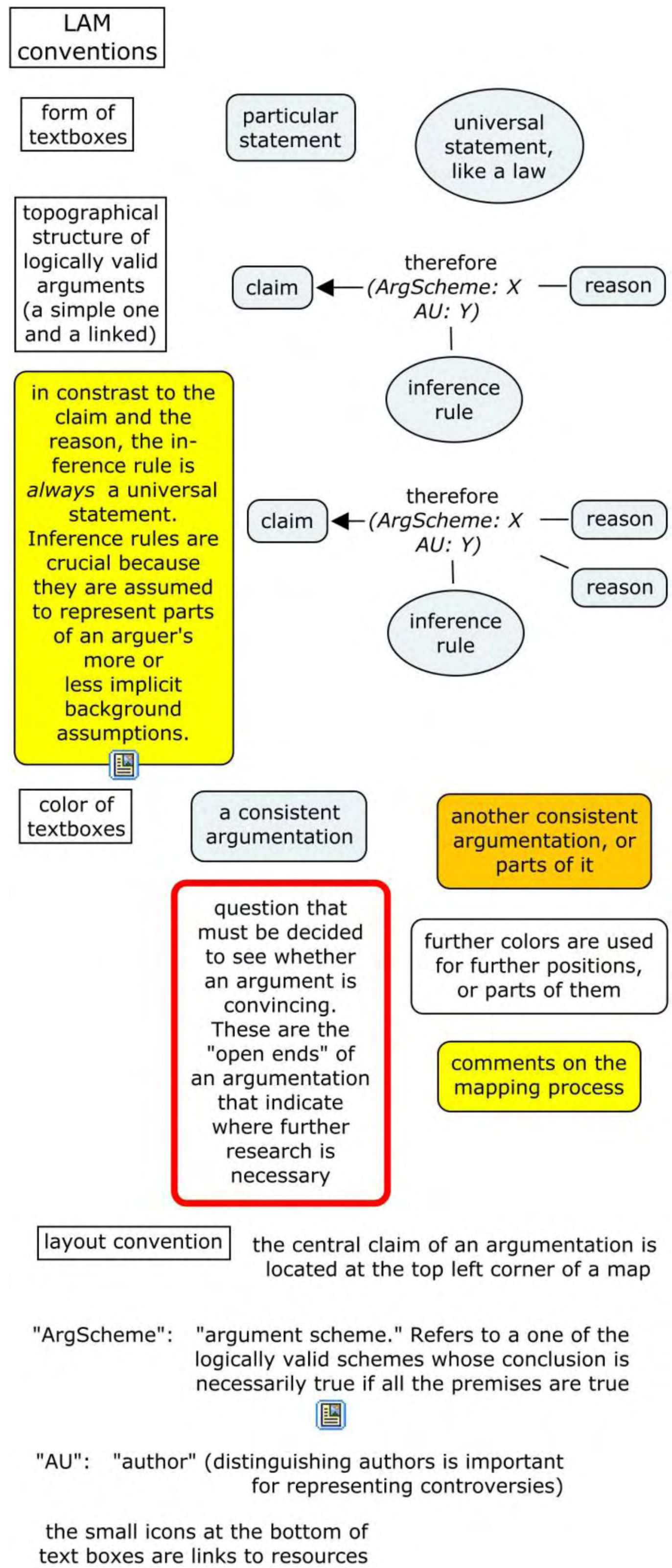
By contrast to most other argument visualization tools, LAM imposes the standard of deductive validity on the construction of the central parts of an argumentation (see the first rule). There are two reasons for this design decision. The first one is that the rigidity of the system should work like a scaffold that helps the user to structure complex situations; the more we are challenged by the rigidity of the system in the construction phase, the more we are challenged to reflect on our basic assumptions that determine how we construct an argument. The second reason is that we are challenged, this way, to reflect in an ongoing process on the completeness of our arguments. Only this way is it possible to make all our implicit assumptions visible.

1. Argument construction

The following sequence of steps assumes that the goal is to construct an argument. For the reconstruction of an argument in a text it is important, first of all, to identify the central argument. It should always be possible to describe the central argument in a few sentences. If your reconstruction of the central arguments gets too complex, you might be on the wrong track with your interpretation.

1. Formulate a claim: the central goal of your argument, a central thesis. Decide whether your claim is a universal statement ("cheating is wrong") or a particular statement ("in case X, cheating is justified"). See the LAM conventions below for how to represent these possibilities.

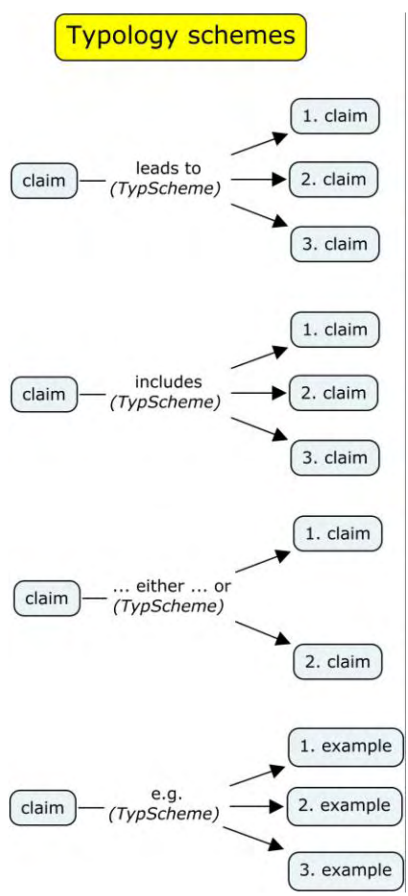
2. Provide a reason for your claim, or a combination of reasons that together are sufficient to justify your claim (simple or linked argument).
3. Select from a list of argument schemes whose logical validity you accept the scheme that is most adequate for your argument (see section 4 for some lists).
4. Transform your argument into a logical argument by adding what is missing, and by reformulating the elements of the argument (claim, reason, inference rule) in such a way that its validity in accordance with the scheme becomes evident
5. Consider possible objections against both the reason(s) and the inference rule, formulate them, and link them to the elements of your map against which they are directed (see section 4 for some "conflict schemes" you can use for this purpose).
6. Decide whether to
    a) develop new arguments against the objections, or
    b) reformulate the original argument in such a way that it can be defended against the objection by, e.g.,
        - including exceptions into the inference rule and limiting the scope of the claim (go back to step 1. or 2.), or
        - using a different argument scheme (go to step 3.), or
        - redefining the meaning of concepts used in the argument (go to step 1. or 2.), or
    c) give up the whole argument
7. In case of 6.c, start again with step 1. or 2.; in the other cases, do as described in 6.a and b.
8. Consider further reasons for your claim and perform steps 3. to 7. for them as well.



2. Argument evaluation

The following criteria allow the evaluation of argument maps. Evaluation is important since it is always possible to represent a text or an issue in many different ways. Evaluation should motivate the revision or refinement of an argument map.

1. **Validity**: Central and controversial arguments must be formulated in logically valid form, that is in correspondence to the argument schemes listed in Section 4.
2. **Acceptability**: Check each claim in your text boxes and ask yourself whether you can accept it as it is formulated. If the claim is too complex, or if it is hard to see whether it is acceptable or not, reformulate or divide into separate claims. This is especially important when you are reconstructing someone else's argumentation and you assume claims that you cannot directly quote from your source. It is easy to write something down, but you will never be able to defend it if it is either nonsense or hardly acceptable. If a claim is not acceptable, revise the entire argument; if it should be acceptable based on further arguments, then develop these arguments to support it.
3. **Simplicity**: Generally, the simpler an argumentation the more convincing. The criterion of simplicity should motivate you to focus from the very beginning on the essential message of your argumentation. Don't get confused by too much detail and things that are only marginally important. Work from the center to the margins, and do so only when you are convinced that you found the best possible form for the center of your argumentation. Then focus on supporting the reasons of your central argument and on defending these reasons against possible objections.
4. **Balance**: The stronger a position, the weaker is often the argument for it, and the weaker a position, the easier it is to formulate a strong argument. Finding here the right balance is crucial. Everything depends on how you phrase the final conclusion of your argumentation. Experiment with different formulations and try to develop arguments that are strong enough for your position.



3. Classification of possibilities or options

Sometimes it is necessary to distinguish different cases for a certain claim so that arguments or objections can be developed for each case. This can be done by means of "typology schemes." See a list of examples on the right. (TypScheme)

4. Objections

Different forms of objections to specified elements of an argumentation can be represented by a variety of "conflict schemes" (ConfScheme). Their main function is to motivate the improvement or revision of an argumentation (see sect. 4 for a list).

5. Questions and comments

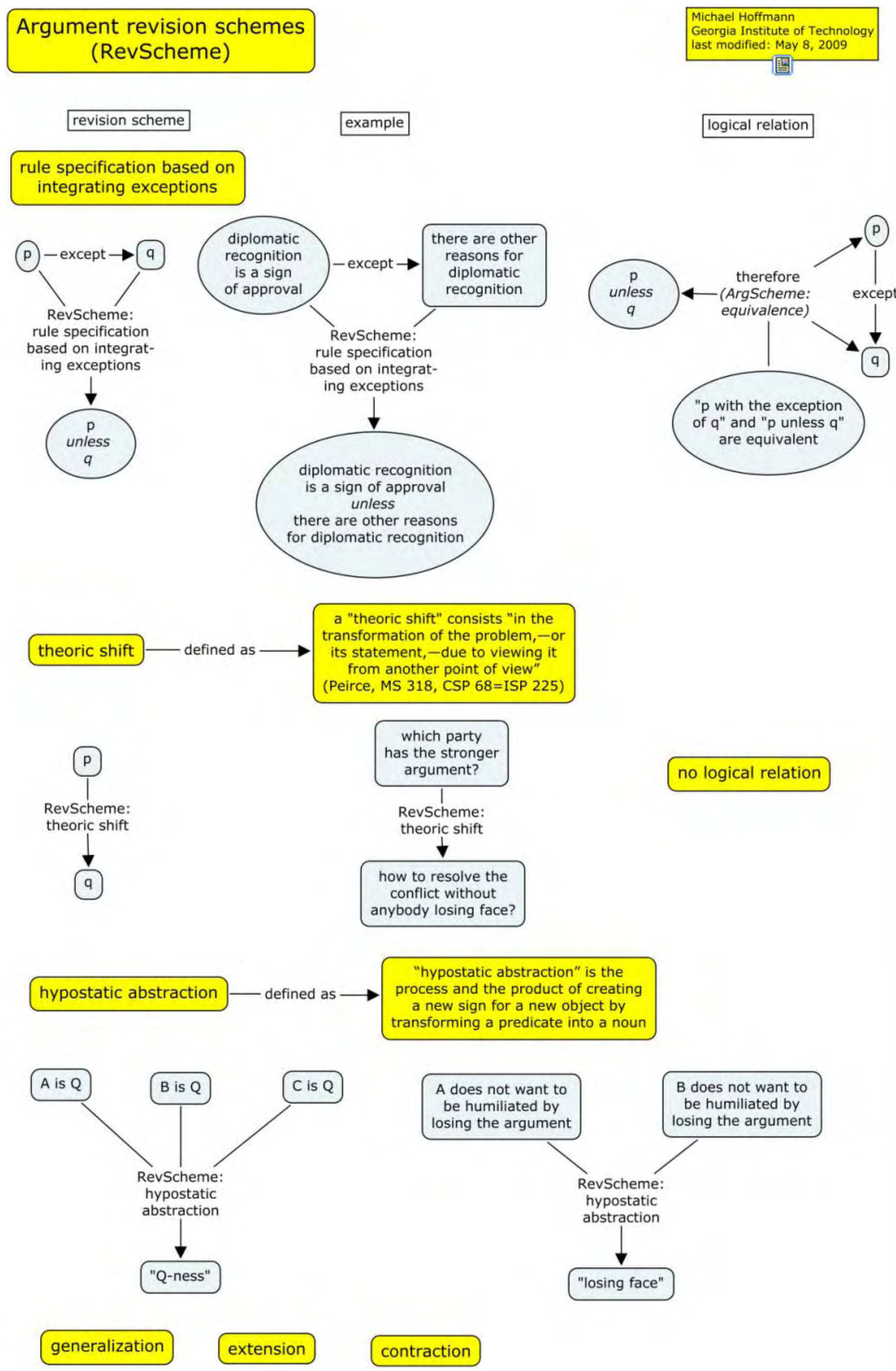
Sometimes an argumentation leads to an open question that must be decided to see whether an argument is convincing. These questions are the "open ends" of an argumentation that indicate where further research is necessary. Like comments to an argumentation, questions are indicated by a certain color in LAM (see the LAM conventions above).

6. Supporting data

It is possible to add further information and supporting data in LAM maps.

7. Argument revision

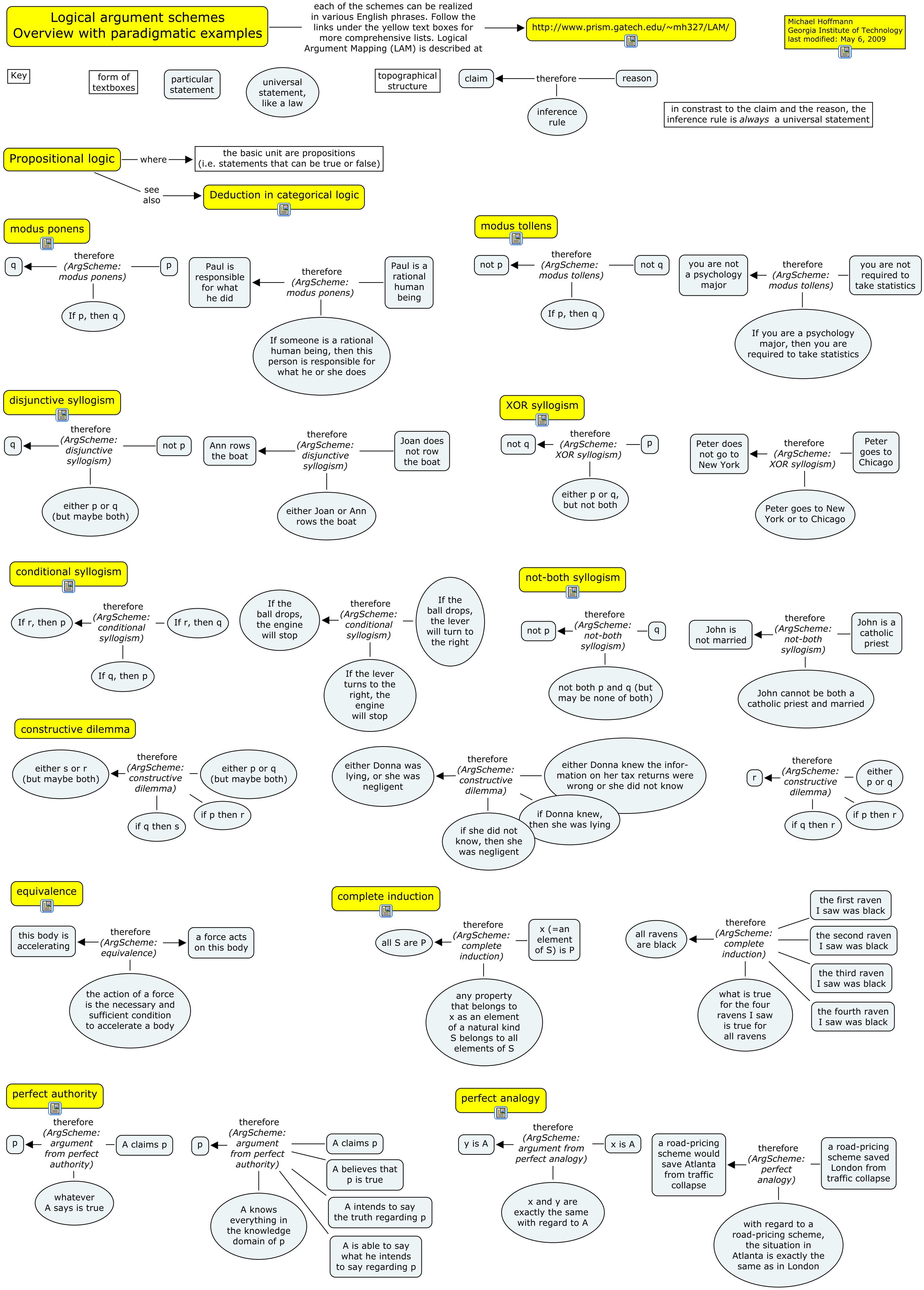
In order to represent the development of an argumentation, it might be necessary to show how certain arguments or objections lead to revisions of parts of an argumentation. For this, LAM offers a set of "revision schemes" (see on the right).



The list of "revisions" that can be represented in LAM specifies different possibilities of revising either individual statements or the structure of arguments. Since the specification of revisions is something that we do with regard to an already given argumentation, representing revisions in a map means that both an argument and a meta-level of reflecting on the argumentation are represented in the same map.

4. Schemes

Please find examples of LAM maps at http://www.prism.gatech.edu/~mh327/LAM.


Logical argument schemes
Overview with paradigmatic examples
each of the schemes can be realized in various English phrases. Follow the links under the yellow text boxes for more comprehensive lists. Logical Argument Mapping (LAM) is described at
http://www.prism.gatech.edu/~mh327/LAM/
Michael Hoffmann
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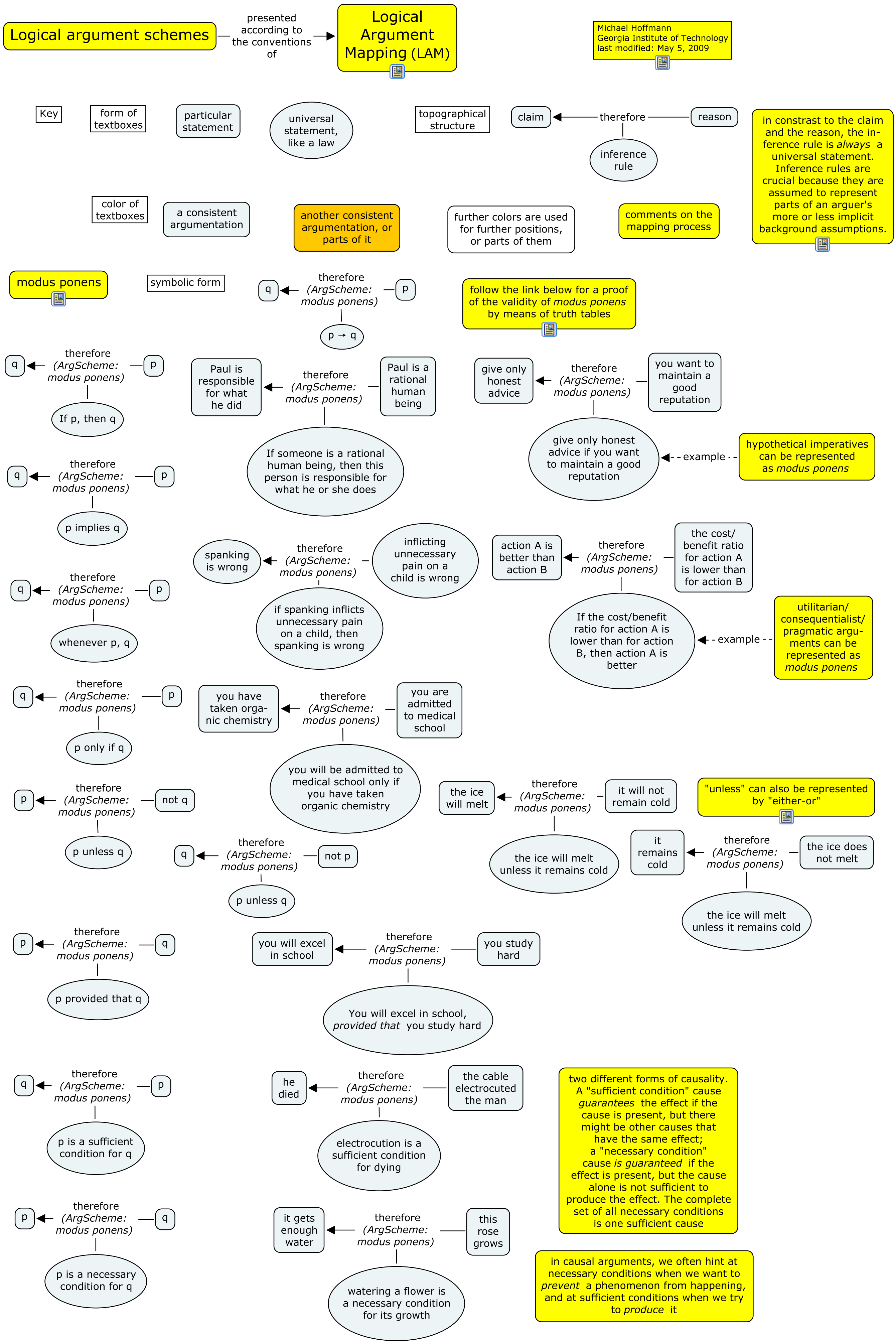
last modified: May 6, 2009
Key
form of textboxes
particular statement
universal statement, like a law
topographical structure
claim
therefore
reason
inference rule
in constrast to the claim and the reason, the inference rule is *always* a universal statement
Propositional logic
where
the basic unit are propositions (i.e. statements that can be true or false)
see also
Deduction in categorical logic
modus ponens
q
therefore *(ArgScheme: modus ponens)*
p
If p, then q
Paul is responsible for what he did
therefore *(ArgScheme: modus ponens)*
Paul is a rational human being
If someone is a rational human being, then this person is responsible for what he or she does
modus tollens
not p
therefore *(ArgScheme: modus tollens)*
not q
If p, then q
you are not a psychology major
therefore *(ArgScheme: modus tollens)*
you are not required to take statistics
If you are a psychology major, then you are required to take statistics
disjunctive syllogism
q
therefore *(ArgScheme: disjunctive syllogism)*
not p
either p or q (but maybe both)
Ann rows the boat
therefore *(ArgScheme: disjunctive syllogism)*
Joan does not row the boat
either Joan or Ann rows the boat
XOR syllogism
not q
therefore *(ArgScheme: XOR syllogism)*
p
either p or q, but not both
Peter does not go to New York
therefore *(ArgScheme: XOR syllogism)*
Peter goes to Chicago
Peter goes to New York or to Chicago
conditional syllogism
If r, then p
therefore *(ArgScheme: conditional syllogism)*
If r, then q
If q, then p
If the ball drops, the engine will stop
therefore *(ArgScheme: conditional syllogism)*
If the ball drops, the lever will turn to the right
If the lever turns to the right, the engine will stop
not-both syllogism
not p
therefore *(ArgScheme: not-both syllogism)*
q
not both p and q (but may be none of both)
John is not married
therefore *(ArgScheme: not-both syllogism)*
John is a catholic priest
John cannot be both a catholic priest and married
constructive dilemma
either s or r (but maybe both)
therefore *(ArgScheme: constructive dilemma)*
either p or q (but maybe both)
if q then s
if p then r
either Donna was lying, or she was negligent
therefore *(ArgScheme: constructive dilemma)*
either Donna knew the information on her tax returns were wrong or she did not know
if she did not know, then she was negligent
if Donna knew, then she was lying
r
therefore *(ArgScheme: constructive dilemma)*
either p or q
if q then r
if p then r
equivalence
this body is accelerating
therefore *(ArgScheme: equivalence)*
a force acts on this body
the action of a force is the necessary and sufficient condition to accelerate a body
complete induction
all S are P
therefore *(ArgScheme: complete induction)*
x (=an element of S) is P
any property that belongs to x as an element of a natural kind S belongs to all elements of S
all ravens are black
therefore *(ArgScheme: complete induction)*
the first raven I saw was black
the second raven I saw was black
the third raven I saw was black
the fourth raven I saw was black
what is true for the four ravens I saw is true for all ravens
perfect authority
p
therefore *(ArgScheme: argument from perfect authority)*
A claims p
whatever A says is true
p
therefore *(ArgScheme: argument from perfect authority)*
A claims p
A believes that p is true
A intends to say the truth regarding p
A is able to say what he intends to say regarding p
A knows everything in the knowledge domain of p
perfect analogy
y is A
therefore *(ArgScheme: argument from perfect analogy)*
x is A
x and y are exactly the same with regard to A
a road-pricing scheme would save Atlanta from traffic collapse
therefore *(ArgScheme: perfect analogy)*
a road-pricing scheme saved London from traffic collapse
with regard to a road-pricing scheme, the situation in Atlanta is exactly the same as in London


Logical argument schemes
presented according to the conventions of
Logical Argument Mapping (LAM)
Michael Hoffmann
Georgia Institute of Technology
last modified: May 5, 2009
Key
form of textboxes
particular statement
universal statement, like a law
topographical structure
claim
therefore
reason
inference rule
in constrast to the claim and the reason, the inference rule is *always* a universal statement. Inference rules are crucial because they are assumed to represent parts of an arguer's more or less implicit background assumptions.
color of textboxes
a consistent argumentation
another consistent argumentation, or parts of it
further colors are used for further positions, or parts of them
comments on the mapping process
modus ponens
symbolic form
q
therefore (ArgScheme: modus ponens)
p
p → q
follow the link below for a proof of the validity of *modus ponens* by means of truth tables
q
therefore (ArgScheme: modus ponens)
p
If p, then q
Paul is responsible for what he did
therefore (ArgScheme: modus ponens)
Paul is a rational human being
If someone is a rational human being, then this person is responsible for what he or she does
give only honest advice
therefore (ArgScheme: modus ponens)
you want to maintain a good reputation
give only honest advice if you want to maintain a good reputation
example
hypothetical imperatives can be represented as *modus ponens*
q
therefore (ArgScheme: modus ponens)
p
p implies q
spanking is wrong
therefore (ArgScheme: modus ponens)
inflicting unnecessary pain on a child is wrong
if spanking inflicts unnecessary pain on a child, then spanking is wrong
action A is better than action B
therefore (ArgScheme: modus ponens)
the cost/benefit ratio for action A is lower than for action B
If the cost/benefit ratio for action A is lower than for action B, then action A is better
example
utilitarian/consequentialist/pragmatic arguments can be represented as *modus ponens*
q
therefore (ArgScheme: modus ponens)
p
whenever p, q
q
therefore (ArgScheme: modus ponens)
p
p only if q
you have taken organic chemistry
therefore (ArgScheme: modus ponens)
you are admitted to medical school
you will be admitted to medical school only if you have taken organic chemistry
p
therefore (ArgScheme: modus ponens)
not q
p unless q
q
therefore (ArgScheme: modus ponens)
not p
p unless q
the ice will melt
therefore (ArgScheme: modus ponens)
it will not remain cold
the ice will melt unless it remains cold
"unless" can also be represented by "either-or"
it remains cold
therefore (ArgScheme: modus ponens)
the ice does not melt
the ice will melt unless it remains cold
p
therefore (ArgScheme: modus ponens)
q
p provided that q
you will excel in school
therefore (ArgScheme: modus ponens)
you study hard
You will excel in school, *provided that* you study hard
q
therefore (ArgScheme: modus ponens)
p
p is a sufficient condition for q
he died
therefore (ArgScheme: modus ponens)
the cable electrocuted the man
electrocution is a sufficient condition for dying
two different forms of causality. A "sufficient condition" cause *guarantees* the effect if the cause is present, but there might be other causes that have the same effect; a "necessary condition" cause *is guaranteed* if the effect is present, but the cause alone is not sufficient to produce the effect. The complete set of all necessary conditions is one sufficient cause
p
therefore (ArgScheme: modus ponens)
q
p is a necessary condition for q
it gets enough water
therefore (ArgScheme: modus ponens)
this rose grows
watering a flower is a necessary condition for its growth
in causal arguments, we often hint at necessary conditions when we want to *prevent* a phenomenon from happening, and at sufficient conditions when we try to *produce* it

Logical argument schemes

presented according to the conventions of

Logical Argument Mapping (LAM)

Michael Hoffmann
Georgia Institute of Technology
last modified: May 6, 2009

Key

form of textboxes

particular statement

universal statement, like a law

topographical structure

claim ← therefore — reason

inference rule

color of textboxes

a consistent argumentation

another consistent argumentation, or parts of it

further colors are used for further positions, or parts of them

comments on the mapping process

in constrast to the claim and the reason, the inference rule is *always* a universal statement. Inference rules are crucial because they are assumed to represent parts of an arguer's more or less implicit background assumptions.

modus tollens

symbolic form

~p ← therefore *(ArgScheme: modus tollens)* — ~q

p → q

follow the link below for a proof of the validity of *modus tollens* by means of truth tables

not p ← therefore *(ArgScheme: modus tollens)* — not q

If p, then q

you are not a psychology major ← therefore *(ArgScheme: modus tollens)* — you are not required to take statistics

If you are a psychology major, then you are required to take statistics

you did not want to maintain a good reputation ← therefore *(ArgScheme: modus tollens)* — you did not give honest advice

if you want to maintain a good reputation, then give only honest advice

not p ← therefore *(ArgScheme: modus tollens)* — not q

p implies q

the cost/benefit ratio for action A is higher than for action B ← therefore *(ArgScheme: modus tollens)* — action A is not better than action B

If the cost/benefit ratio for action A is lower than for action B, then action A is better

not p ← therefore *(ArgScheme: modus tollens)* — not q

p only if q

you will not be admitted to medical school ← therefore *(ArgScheme: modus tollens)* — you have not taken organic chemistry

you will be admitted to medical school only if you have taken organic chemistry

in 2003, invading Iraq was not justified ← therefore *(ArgScheme: modus tollens* — in 2003, there was no immanent threat from Iraq

invading a country is justified only if this country poses an immanent threat

not p ← therefore *(ArgScheme: modus tollens)* — not q

whenever p, q

not q ← therefore *(ArgScheme: modus tollens)* — not p

p provided that q

you do not study hard ← therefore *(ArgScheme: modus tollens)* — you do not excel in school

You will excel in school, *provided that* you study hard

not p ← therefore *(ArgScheme: modus tollens)* — not q

p is a sufficient condition for q

the cable did not electrocute the man ← therefore *(ArgScheme: modus tollens)* — the man did not die

electrocution is a sufficient condition for dying

not q ← therefore *(ArgScheme: modus tollens)* — not p

p is a necessary condition for q

it will not grow ← therefore *(ArgScheme: modus tollens)* — this rose has never been watered

watering a flower is a necessary condition for its growth

Logical argument schemes

presented according to the conventions of → **Logical Argument Mapping (LAM)**

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Key

form of textboxes: particular statement; universal statement, like a law

topographical structure: claim ← therefore — reason; therefore — inference rule

in constrast to the claim and the reason, the inference rule is *always* a universal statement. Inference rules are crucial because they are assumed to represent parts of an arguer's more or less implicit background assumptions.

color of textboxes: a consistent argumentation; another consistent argumentation, or parts of it; further colors are used for further positions, or parts of them; comments on the mapping process

symbolic form | English equivalents | examples of arguments on facts (based on descriptive statements, as used in science, for instance) | comments

disjunctive syllogism

the validity of the disjunctive syllogism is based on the logical definition of "either-or."Click the link below to see the corresponding truth table definition

q ← therefore *(ArgScheme: disjunctive syllogism)* — ¬p; inference rule: p v q

q ← therefore *(ArgScheme: disjunctive syllogism)* — not p; inference rule: either p or q (but maybe both)

Ann rows the boat ← therefore *(ArgScheme: disjunctive syllogism)* — Joan does not row the boat; inference rule: either Joan or Ann will row the boat

Ann rows the boat ← therefore *(ArgScheme: disjunctive syllogism)* — Joan does not row the boat; inference rule: Joan rows unless Ann rows

p ← therefore *(ArgScheme: disjunctive syllogism)* — ¬q; inference rule: p v q

p ← therefore *(ArgScheme: disjunctive syllogism)* — not q; inference rule: either p or q (but maybe both)

Joan rows the boat ← therefore *(ArgScheme: disjunctive syllogism)* — Ann does not row the boat; inference rule: either Joan or Ann rows the boat

Joan rows the boat ← therefore *(ArgScheme: disjunctive syllogism)* — Ann does not row the boat; inference rule: Joan rows unless Ann rows

not-both syllogism

¬p ← therefore *(ArgScheme: not-both syllogism)* — q; inference rule: p | q

not p ← therefore *(ArgScheme: not-both syllogism)* — q; inference rule: not both p and q (but may be none of both)

John is not married ← therefore *(ArgScheme: not-both syllogism)* — John is a catholic priest; inference rule: John cannot be both a catholic priest and married

the validity of the not-both syllogism is based on the logical definition of "not both." Click the link below to see the corresponding truth table definition

¬q ← therefore *(ArgScheme: not-both syllogism)* — p; inference rule: p | q

not q ← therefore *(ArgScheme: not-both syllogism)* — p; inference rule: not both p and q (but may be none of both)

John is not a catholic priest ← therefore *(ArgScheme: not-both syllogism)* — John is married; inference rule: John cannot be both a catholic priest and married

XOR syllogism

¬q ← therefore *(ArgScheme: XOR syllogism)* — p; inference rule: p ≠ q

not q ← therefore *(ArgScheme: XOR syllogism)* — p; inference rule: either p or q, but not both

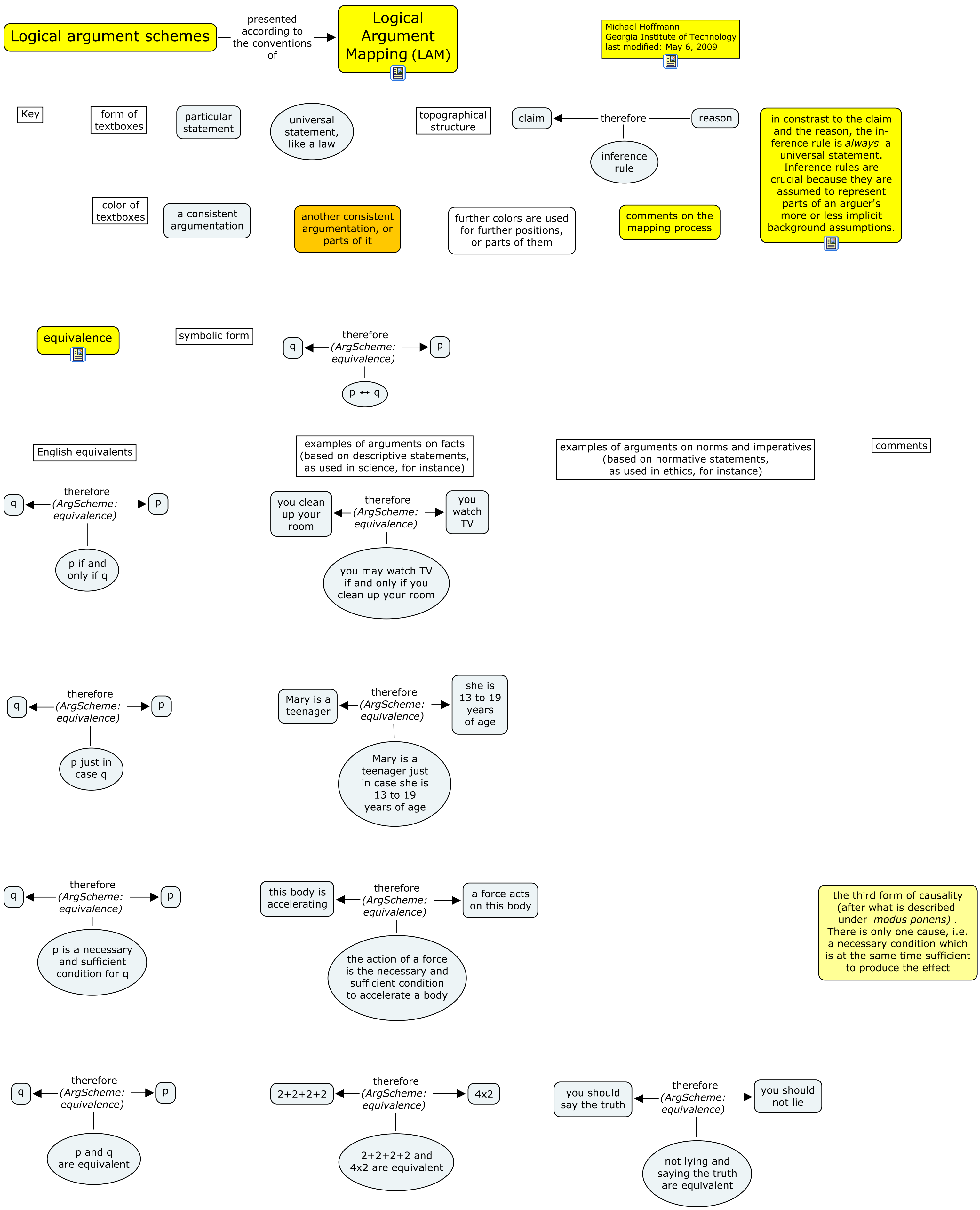
Peter does not go to New York ← therefore *(ArgScheme: XOR syllogism)* — Peter goes to Chicago; inference rule: Peter goes to New York or to Chicago

the validity of the XOR syllogism is based on the logical definition of "exclusive or" (XOR). Click the link below to see the corresponding truth table definition

q ← therefore *(ArgScheme: XOR syllogism)* — ¬p; inference rule: p ≠ q

q ← therefore *(ArgScheme: XOR syllogism)* — not p; inference rule: either p or q, but not both

Peter goes to New York ← therefore *(ArgScheme: XOR syllogism)* — Peter does not go to Chicago; inference rule: Peter goes to New York or to Chicago



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equivalence
symbolic form
q
therefore (ArgScheme: equivalence)
p
p ↔ q
English equivalents
examples of arguments on facts (based on descriptive statements, as used in science, for instance)
examples of arguments on norms and imperatives (based on normative statements, as used in ethics, for instance)
comments
q
therefore (ArgScheme: equivalence)
p
p if and only if q
you clean up your room
therefore (ArgScheme: equivalence)
you watch TV
you may watch TV if and only if you clean up your room
q
therefore (ArgScheme: equivalence)
p
p just in case q
Mary is a teenager
therefore (ArgScheme: equivalence)
she is 13 to 19 years of age
Mary is a teenager just in case she is 13 to 19 years of age
q
therefore (ArgScheme: equivalence)
p
p is a necessary and sufficient condition for q
this body is accelerating
therefore (ArgScheme: equivalence)
a force acts on this body
the action of a force is the necessary and sufficient condition to accelerate a body
the third form of causality (after what is described under *modus ponens)* . There is only one cause, i.e. a necessary condition which is at the same time sufficient to produce the effect
q
therefore (ArgScheme: equivalence)
p
p and q are equivalent
2+2+2+2
therefore (ArgScheme: equivalence)
4x2
2+2+2+2 and 4x2 are equivalent
you should say the truth
therefore (ArgScheme: equivalence)
you should not lie
not lying and saying the truth are equivalent

Logical argument schemes — as used in → **Logical Argument Mapping (LAM)**
follow the link below for a description of the method

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Key

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topographical structure: claim ← therefore — reason; inference rule

color of textboxes: a consistent argumentation | another consistent argumentation, or parts of it | further colors are used for further positions, or parts of them | comments on the mapping process

in constrast to the claim and the reason, the inference rule is *always* a universal statement. Inference rules are crucial because they are assumed to represent parts of an arguer's more or less implicit background assumptions.

"AU" means "author" (distinguishing authors is important for representing controversies)

complete induction

all S are P ← therefore *(ArgScheme: complete induction)* — x (=an element of S) is P
Inference rule: any property that belongs to x as an element of a natural kind S belongs to all elements of S

all ravens are black ← therefore *(ArgScheme: complete induction)* — the 1st raven I saw was black; the 2nd raven I saw was black; the 3rd raven I saw was black; the 4th raven I saw was black
Inference rule: what is true for the four ravens I saw is true for all ravens

NOTE:

The decision to allow for the first step of an argument construction *only the logically valid forms* of induction (i.e. complete induction) is based on

1. an iterative 3-step procedure in LAM (1. argument construction; 2. reflection; 3. refinement)
2. the consideration that in the first step the argument should be as strong as possible in order to motivate critical reflection as a precondition for improving and refining the argument.

Thus, even if the inference rule in complete induction is usually hard to defend, it makes sense to construct these arguments initially in these logical valid forms. The goal is to visualize implicit assumptions.

diplomatic recognition is a sign of approval ← therefore *(ArgScheme: complete induction)* — the US government withdrew diplomatic recognition from Cuba when it no longer approved that government

Inference rule: what is true for the US government's identification of diplomatic recognition and approval in the Cuba case defines the relation between diplomatic recognition and approval universally

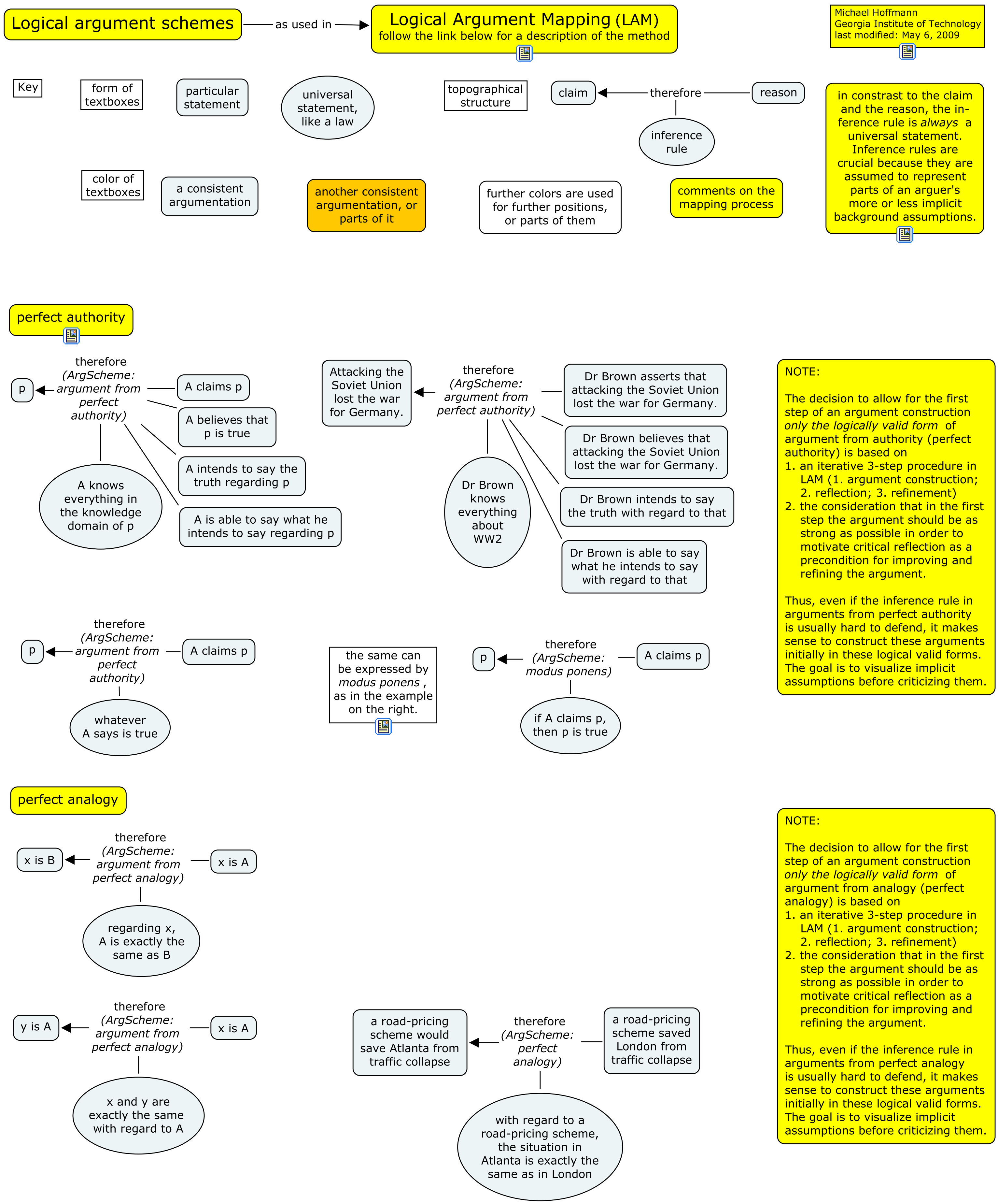
- defeats *(AU=MH)*: Bhutan and Taiwan are countries that the US approves without having official diplomatic relations with them
- defeats *(AU=MH)*: the US recognized the Soviet Union diplomatically without approving it
- supports: the US does not recognize North Korea and Iran diplomatically

all x are A ← therefore *(ArgScheme: complete induction)* — x1 is A; x2 is A; x3 is A; x4 is A
Inference rule: x1,2,3,4 is the complete set of all x

all my friends are nice ← therefore *(ArgScheme: complete induction)* — my friend Paul is nice; my friend Peter is nice; my friend Paula is nice; my friend Posh is nice
Inference rule: Paul, Peter, Paula, and Posh is the complete set of all my friends

if the point of an argument is to specify some probability in the conclusion, then this can often be done in logically valid form by using *modus ponens* , as in the example on the right.

there is a 25% probability that the XY Player you just bought has technical problems ← therefore *(ArgScheme: modus ponens)* — 25 out of 100 custumer reviews reported technical problems with MP3 Player XY
Inference rule: if a quarter of customers report technical problems with MP3 Player XY, then there is a 25% probability that the XY Player you just bought has technical problems



Logical argument schemes
as used in
Logical Argument Mapping (LAM)
follow the link below for a description of the method
Michael Hoffmann
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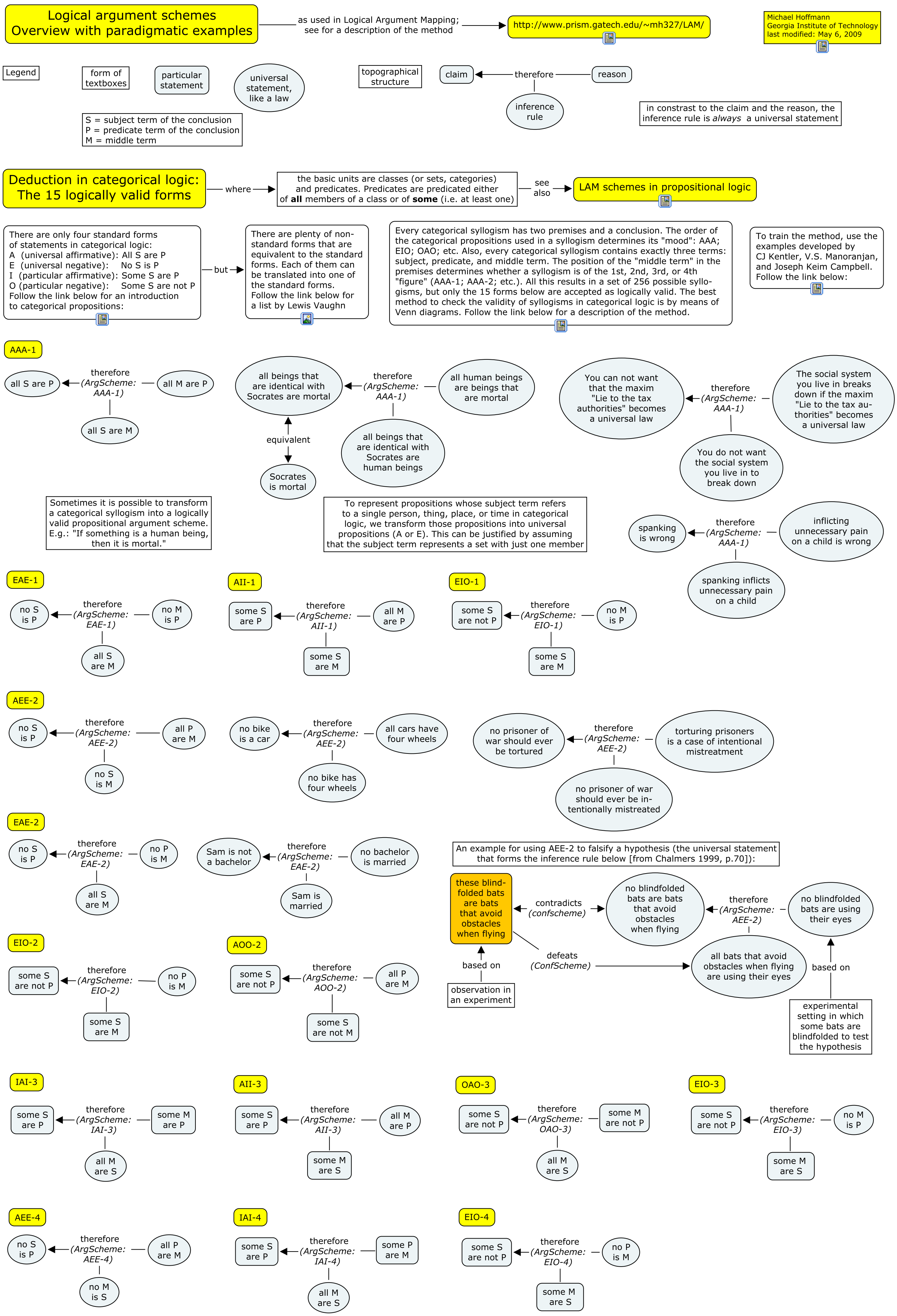
last modified: May 6, 2009
Key
form of textboxes
particular statement
universal statement, like a law
topographical structure
claim
therefore
reason
inference rule
in constrast to the claim and the reason, the inference rule is *always* a universal statement. Inference rules are crucial because they are assumed to represent parts of an arguer's more or less implicit background assumptions.
color of textboxes
a consistent argumentation
another consistent argumentation, or parts of it
further colors are used for further positions, or parts of them
comments on the mapping process
perfect authority
p
therefore *(ArgScheme: argument from perfect authority)*
A claims p
A believes that p is true
A intends to say the truth regarding p
A is able to say what he intends to say regarding p
A knows everything in the knowledge domain of p
Attacking the Soviet Union lost the war for Germany.
therefore *(ArgScheme: argument from perfect authority)*
Dr Brown asserts that attacking the Soviet Union lost the war for Germany.
Dr Brown believes that attacking the Soviet Union lost the war for Germany.
Dr Brown intends to say the truth with regard to that
Dr Brown is able to say what he intends to say with regard to that
Dr Brown knows everything about WW2
NOTE:
The decision to allow for the first step of an argument construction *only the logically valid form* of argument from authority (perfect authority) is based on
1. an iterative 3-step procedure in LAM (1. argument construction; 2. reflection; 3. refinement)
2. the consideration that in the first step the argument should be as strong as possible in order to motivate critical reflection as a precondition for improving and refining the argument.
Thus, even if the inference rule in arguments from perfect authority is usually hard to defend, it makes sense to construct these arguments initially in these logical valid forms. The goal is to visualize implicit assumptions before criticizing them.
p
therefore *(ArgScheme: argument from perfect authority)*
A claims p
whatever A says is true
the same can be expressed by *modus ponens* , as in the example on the right.
p
therefore *(ArgScheme: modus ponens)*
A claims p
if A claims p, then p is true
perfect analogy
x is B
therefore *(ArgScheme: argument from perfect analogy)*
x is A
regarding x, A is exactly the same as B
y is A
therefore *(ArgScheme: argument from perfect analogy)*
x is A
x and y are exactly the same with regard to A
a road-pricing scheme would save Atlanta from traffic collapse
therefore *(ArgScheme: perfect analogy)*
a road-pricing scheme saved London from traffic collapse
with regard to a road-pricing scheme, the situation in Atlanta is exactly the same as in London
NOTE:
The decision to allow for the first step of an argument construction *only the logically valid form* of argument from analogy (perfect analogy) is based on
1. an iterative 3-step procedure in LAM (1. argument construction; 2. reflection; 3. refinement)
2. the consideration that in the first step the argument should be as strong as possible in order to motivate critical reflection as a precondition for improving and refining the argument.
Thus, even if the inference rule in arguments from perfect analogy is usually hard to defend, it makes sense to construct these arguments initially in these logical valid forms. The goal is to visualize implicit assumptions before criticizing them.



Logical argument schemes
Overview with paradigmatic examples
as used in Logical Argument Mapping; see for a description of the method
http://www.prism.gatech.edu/~mh327/LAM/
Michael Hoffmann
Georgia Institute of Technology
last modified: May 6, 2009
Legend
form of textboxes
particular statement
universal statement, like a law
topographical structure
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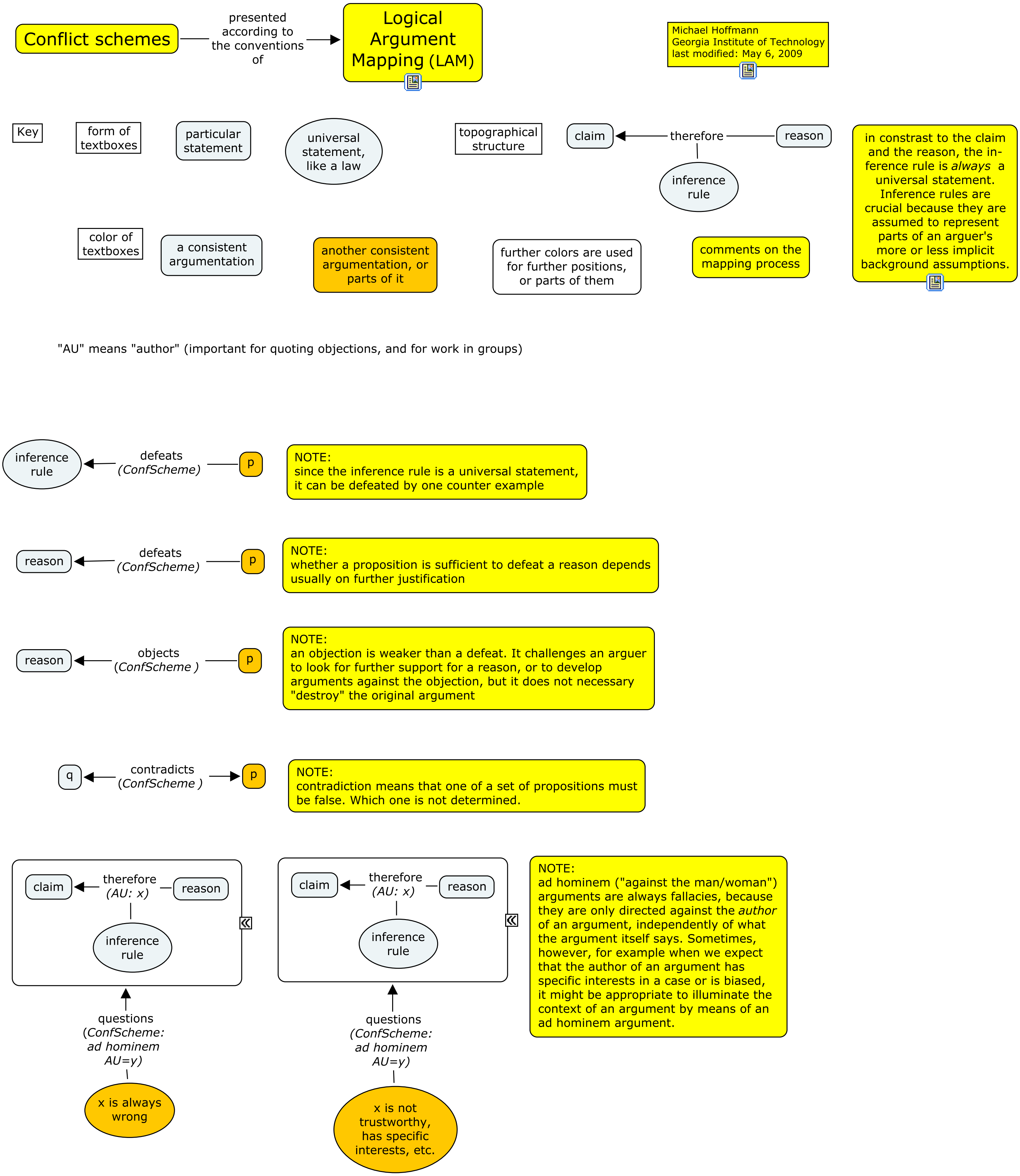
inference rule
in constrast to the claim and the reason, the inference rule is *always* a universal statement
S = subject term of the conclusion
P = predicate term of the conclusion
M = middle term
Deduction in categorical logic: The 15 logically valid forms
where
the basic units are classes (or sets, categories) and predicates. Predicates are predicated either of **all** members of a class or of **some** (i.e. at least one)
see also
LAM schemes in propositional logic
There are only four standard forms of statements in categorical logic:
A (universal affirmative): All S are P
E (universal negative): No S is P
I (particular affirmative): Some S are P
O (particular negative): Some S are not P
Follow the link below for an introduction to categorical propositions:
but
There are plenty of non-standard forms that are equivalent to the standard forms. Each of them can be translated into one of the standard forms. Follow the link below for a list by Lewis Vaughn
Every categorical syllogism has two premises and a conclusion. The order of the categorical propositions used in a syllogism determines its "mood": AAA; EIO; OAO; etc. Also, every categorical syllogism contains exactly three terms: subject, predicate, and middle term. The position of the "middle term" in the premises determines whether a syllogism is of the 1st, 2nd, 3rd, or 4th "figure" (AAA-1; AAA-2; etc.). All this results in a set of 256 possible syllogisms, but only the 15 forms below are accepted as logically valid. The best method to check the validity of syllogisms in categorical logic is by means of Venn diagrams. Follow the link below for a description of the method.
To train the method, use the examples developed by CJ Kentler, V.S. Manoranjan, and Joseph Keim Campbell. Follow the link below:
AAA-1
all S are P
therefore (*ArgScheme: AAA-1*)
all M are P
all S are M
all beings that are identical with Socrates are mortal
therefore (*ArgScheme: AAA-1*)
all human beings are beings that are mortal
all beings that are identical with Socrates are human beings
equivalent
Socrates is mortal
You can not want that the maxim "Lie to the tax authorities" becomes a universal law
therefore (*ArgScheme: AAA-1*)
The social system you live in breaks down if the maxim "Lie to the tax authorities" becomes a universal law
You do not want the social system you live in to break down
Sometimes it is possible to transform a categorical syllogism into a logically valid propositional argument scheme. E.g.: "If something is a human being, then it is mortal."
To represent propositions whose subject term refers to a single person, thing, place, or time in categorical logic, we transform those propositions into universal propositions (A or E). This can be justified by assuming that the subject term represents a set with just one member
spanking is wrong
therefore (*ArgScheme: AAA-1*)
inflicting unnecessary pain on a child is wrong
spanking inflicts unnecessary pain on a child
EAE-1
no S is P
therefore (*ArgScheme: EAE-1*)
no M is P
all S are M
AII-1
some S are P
therefore (*ArgScheme: AII-1*)
all M are P
some S are M
EIO-1
some S are not P
therefore (*ArgScheme: EIO-1*)
no M is P
some S are M
AEE-2
no S is P
therefore (*ArgScheme: AEE-2*)
all P are M
no S is M
no bike is a car
therefore (*ArgScheme: AEE-2*)
all cars have four wheels
no bike has four wheels
no prisoner of war should ever be tortured
therefore (*ArgScheme: AEE-2*)
torturing prisoners is a case of intentional mistreatment
no prisoner of war should ever be intentionally mistreated
EAE-2
no S is P
therefore (*ArgScheme: EAE-2*)
no P is M
all S are M
Sam is not a bachelor
therefore (*ArgScheme: EAE-2*)
no bachelor is married
Sam is married
An example for using AEE-2 to falsify a hypothesis (the universal statement that forms the inference rule below [from Chalmers 1999, p.70]):
these blindfolded bats are bats that avoid obstacles when flying
contradicts (*confscheme*)
no blindfolded bats are bats that avoid obstacles when flying
therefore (*ArgScheme: AEE-2*)
no blindfolded bats are using their eyes
all bats that avoid obstacles when flying are using their eyes
defeats (*ConfScheme*)
based on
observation in an experiment
based on
experimental setting in which some bats are blindfolded to test the hypothesis
EIO-2
some S are not P
therefore (*ArgScheme: EIO-2*)
no P is M
some S are M
AOO-2
some S are not P
therefore (*ArgScheme: AOO-2*)
all P are M
some S are not M
IAI-3
some S are P
therefore (*ArgScheme: IAI-3*)
some M are P
all M are S
AII-3
some S are P
therefore (*ArgScheme: AII-3*)
all M are P
some M are S
OAO-3
some S are not P
therefore (*ArgScheme: OAO-3*)
some M are not P
all M are S
EIO-3
some S are not P
therefore (*ArgScheme: EIO-3*)
no M is P
some M are S
AEE-4
no S is P
therefore (*ArgScheme: AEE-4*)
all P are M
no M is S
IAI-4
some S are P
therefore (*ArgScheme: IAI-4*)
some P are M
all M are S
EIO-4
some S are not P
therefore (*ArgScheme: EIO-4*)
no P is M
some M are S


Conflict schemes
presented according to the conventions of
Logical Argument Mapping (LAM)
Michael Hoffmann
Georgia Institute of Technology
last modified: May 6, 2009
Key
form of textboxes
particular statement
universal statement, like a law
topographical structure
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in constrast to the claim and the reason, the inference rule is *always* a universal statement. Inference rules are crucial because they are assumed to represent parts of an arguer's more or less implicit background assumptions.
color of textboxes
a consistent argumentation
another consistent argumentation, or parts of it
further colors are used for further positions, or parts of them
comments on the mapping process
"AU" means "author" (important for quoting objections, and for work in groups)
inference rule
defeats *(ConfScheme)*
p
NOTE:
since the inference rule is a universal statement, it can be defeated by one counter example
reason
defeats *(ConfScheme)*
p
NOTE:
whether a proposition is sufficient to defeat a reason depends usually on further justification
reason
objects *(ConfScheme)*
p
NOTE:
an objection is weaker than a defeat. It challenges an arguer to look for further support for a reason, or to develop arguments against the objection, but it does not necessary "destroy" the original argument
q
contradicts *(ConfScheme)*
p
NOTE:
contradiction means that one of a set of propositions must be false. Which one is not determined.
claim
therefore *(AU: x)*
reason
inference rule
questions *(ConfScheme: ad hominem AU=y)*
x is always wrong
claim
therefore *(AU: x)*
reason
inference rule
questions *(ConfScheme: ad hominem AU=y)*
x is not trustworthy, has specific interests, etc.
NOTE:
ad hominem ("against the man/woman") arguments are always fallacies, because they are only directed against the *author* of an argument, independently of what the argument itself says. Sometimes, however, for example when we expect that the author of an argument has specific interests in a case or is biased, it might be appropriate to illuminate the context of an argument by means of an ad hominem argument.